

walls. Other configurations of tabs 42 to produce other desired flow characteristics will become readily apparent to those skilled in the art, given the benefit of this disclosure.

FIGS. 6-9 illustrate various embodiments of plate 40 which are shown prior to bending tabs 42 outwardly. Therefore, crease 44 is shown in dashed lines in FIGS. 6-9. In one preferred embodiment, shown in FIG. 6, plate 40 has a plurality of rows of tabs 42, with each row having a tab 42 positioned above and a tab 42 positioned below longitudinal axis L. In this preferred embodiment, longitudinal axis A of each tab 42 is substantially parallel to longitudinal axis L of plate 40.

In another alternative embodiment shown in FIG. 7, tabs 42 are oriented such that their longitudinal axis A is angled with respect to longitudinal axis L of plate 40. Some of tabs 42 have their longitudinal axis A angled upwardly from their leading edge to their trailing edge with respect to longitudinal axis L, while others have their longitudinal axis A angled downwardly from their leading edge to their trailing edge with respect to longitudinal axis L. By angling the tabs upwardly and downwardly as well as outwardly, the flow of heated air is deflected up and down as well as left and right (for a plate which is oriented in a vertical or horizontal direction) within the heat transfer tubes, thereby providing additional mixing of the heated air. In the embodiment illustrated in FIG. 7, the rows alternate between having each tab in the row angled upwardly and having each tab in the row angled downwardly. In certain preferred embodiments, tabs 42 are angled upwardly or downwardly approximately 20° from longitudinal axis L. Thus, crease 44 of each tab 42 forms an acute angle with either an upstream or a downstream, with respect to the flow of heating fluid, portion of a longitudinal edge, e.g., the upper edge, of baffle plate 40. Other suitable orientations of the angle of tabs 42 will become readily apparent to those skilled in the art, given the benefit of this disclosure.

Another alternative embodiment is shown in FIG. 8, where tabs 42 of each row are vertically offset from tabs 42 in adjacent rows such that there are tabs 42 in all but the first row which are directly downstream of a web 46 in the upstream adjacent row. This prevents any long channels of uninterrupted flow from being established along the length of heat transfer tube 16. In the illustrated embodiment, the rows alternate between having three tabs 42 and four tabs 42. It is to be appreciated that the rows may have the same, or different, number of tabs 42 from each of the other rows.

Yet another alternative embodiment is shown in FIG. 9, which is similar to the embodiment shown in FIG. 8, however, plate 40 in the embodiment shown in FIG. 9 has a higher number of tabs 42 at its downstream end than at its upstream end. That is, the number of tabs 42 per unit length of plate 40 increases along plate 40 in a downstream direction to provide increased heat transfer.

Another alternative embodiment is shown in FIGS. 10, 11. Perimeter plate 50 is positioned between plates 40 and an inside surface of heat transfer tube 16. That is, perimeter plate 50 surrounds, at least partially, plates 40 and the plane of plate 50 is substantially perpendicular to the plane of plates 40. Thus, perimeter plate 50 reduces the tendency for the heated air to travel along the wall of heat transfer tube 16, unobstructed by any tabs 42. In the embodiment illustrated in FIG. 11, perimeter plate 50 has an inverted U-shape. Plate 50 can be slid over plates 40 such that plate 50 is positioned between the inside surface of heat transfer tube 16 and the tops and sides of plates 40. It is to be appreciated that plate 50 may be formed so as to fit between

the inside surface of heat transfer tube 16 and any or all of the tops, bottoms, and sides of plates 40. In the embodiment illustrated, where heat transfer tube 16 is circular, plate 50 has a circular outer perimeter to mate with the surface of heat transfer tube 16 and plate 50 generally comprises three segments of a circle. Naturally, plate 50 may have a different shaped perimeter to match that of the heat transfer tube within which it is positioned. Tabs 52 extend from plate 50 in a direction substantially perpendicular to the plane of plate 50 and abut the inside surface of heat transfer tube 16. Tabs 52 help reduce any tendency of plate 50 from twisting within heat transfer tube 16.

In light of the foregoing disclosure of the invention and description of the preferred embodiments, those skilled in this area of technology will readily understand that various modifications and adaptations can be made without departing from the true scope and spirit of the invention. All such modifications and adaptations are intended to be covered by the following claims.

I claim:

1. A heat exchanger for a fryer system comprising, in combination:

at least one heat transfer conduit having a heating fluid passing therethrough;

a baffle plate disposed within the at least one heat transfer conduit, defining a plane and having a first surface, an opposed second surface, and a longitudinal axis which divides the baffle plate into a first portion and a second portion;

a plurality of tabs, each tab having a longitudinal axis and extending outwardly away from one of the first and second surfaces of the baffle plate, an intersection of the tab and the baffle plate defining a crease, at least one of the tabs being positioned in the first portion of the baffle plate and at least one of the tabs being positioned in the second portion of the baffle plate; and

a plurality of webs, each web separating a tab from another tab adjacent the tab in a direction substantially perpendicular to the longitudinal axis of the tab.

2. A heat exchanger according to claim 1, wherein each tab extends outwardly at an acute angle with respect to the surface from which it extends.

3. A heat exchanger according to claim 1, wherein each tab extends outwardly at an angle of approximately 45° with respect to the surface from which it extends.

4. A heat exchanger according to claim 1, wherein the tabs are positioned in a plurality of rows, each row extending in a direction substantially perpendicular to the longitudinal axis of the baffle plate.

5. A heat exchanger according to claim 1, wherein the crease of at least one tab forms an acute angle with the longitudinal axis of the baffle plate.

6. A heat exchanger according to claim 1, wherein the crease of each tab forms an acute angle with the longitudinal axis of the baffle plate.

7. A heat exchanger according to claim 1, wherein the crease of at least one tab forms an acute angle with a portion of a longitudinal edge of the baffle plate which is downstream of the crease of the at least one tab, and the crease of at least one other tab forms an acute angle with a portion of the longitudinal edge of the baffle plate which is upstream of the crease of the at least one other tab.

8. A heat exchanger according to claim 4, wherein the rows alternate between having the crease of each tab in a row form an acute angle with a portion of a longitudinal edge of the baffle plate which is downstream, with respect to

the flow of heating fluid, of the row and having the crease of each tab in a row form an acute angle with a portion of the longitudinal edge of the baffle plate which is upstream, with respect to the flow of heating fluid, of the row.

9. A heat exchanger according to claim 4, wherein at least one row having the crease of each tab in that row form an acute angle with a portion of a longitudinal edge of the baffle plate which is downstream, with respect to the flow of heating fluid, of that row is separated from at least one other row having the crease of each tab in that other row form an acute angle with a portion of the longitudinal edge of the baffle plate which is upstream, with respect to the flow of heating fluid, of that row by a separate row having the crease of each tab in that separate row form a right angle with the longitudinal edge of the baffle plate.

10. A heat exchanger according to claim 1, wherein the crease of at least one tab is positioned directly downstream, with respect to the flow of heating fluid, of the web between two tabs which are adjacent and upstream of the at least one tab.

11. A heat exchanger according to claim 1, wherein the crease of each tab is upstream, with respect to the flow of heating fluid, of a main body of the each tab.

12. A heat exchanger according to claim 1, wherein the crease of each tab is downstream, with respect to the flow of heating fluid, of a main body of the each tab.

13. A heat exchanger according to claim 1, wherein the crease of at least one tab is downstream, with respect to the flow of heating fluid, of a main body of the at least one tab and the crease of at least one other tab is upstream, with respect to the flow of heating fluid, of the main body of the at least one other tab.

14. A heat exchanger according to claim 1, wherein each of the tabs comprises a portion of the baffle plate which is bent outwardly away from one of the first and second surfaces.

15. A heat exchanger according to claim 1, further comprising at least one additional baffle plate disposed in the at least one heat transfer conduit.

16. A heat exchanger according to claim 15, wherein the at least one additional baffle plate has a different configuration of tabs than at least one other baffle plate.

17. A heat exchanger according to claim 15, wherein the at least one additional baffle plate has a different number of tabs than at least one other baffle plate.

18. A heat exchanger according to claim 15, further comprising a perimeter plate defining a plane and positioned between an inside surface of the at least one heat transfer conduit and the baffle plates.

19. A heat exchanger according to claim 18, wherein the plane of the perimeter plate is substantially perpendicular to the planes of the baffle plates.

20. A heat exchanger according to claim 1, wherein a portion of the baffle plate has a greater number of tabs than an equally sized portion of the baffle plate which is upstream, with respect to the flow of heating fluid, of the portion of the baffle plate.

21. A heat exchanger according to claim 1, wherein the number of tabs per unit length increases along the baffle plate in a downstream direction with respect to the flow of heating fluid.

22. A heat exchanger according to claim 1, further comprising a perimeter plate defining a plane and positioned between an inside surface of the at least one heat transfer conduit and the baffle plate.

23. A heat exchanger according to claim 22, wherein the plane of the perimeter plate is substantially perpendicular to the plane of the baffle plate.

24. A heat exchanger according to claim 1, wherein the longitudinal axis of the baffle plate extends substantially parallel to a longitudinal axis of the at least one heat transfer conduit.

25. A baffle for a heat exchanger in a deep fryer, the heat exchanger having at least one heat transfer conduit with a heating fluid passing therethrough, comprising, in combination:

a baffle plate positioned within the at least one heat transfer conduit defining a plane and having a first surface, an opposed second surface, and a longitudinal axis which divides the baffle plate into a first portion and a second portion;

a plurality of rows of tabs, each tab comprising a portion of the baffle plate bent outwardly from one of the first and second surfaces, having a longitudinal axis, and defining a crease along an intersection of the tab and the baffle plate, at least one tab in each row being positioned in the first portion of the baffle plate, at least one tab in each row being positioned in the second portion of the baffle plate, each row having the crease of all of its tabs form an acute angle with one of a portion of a longitudinal edge of the baffle plate which is upstream, with respect to the flow of heating fluid, of a main body of its respective tab and a portion of the longitudinal edge which is downstream, with respect to the flow of heating fluid, of the main body of its respective tab and the rows adjacent to the each row having the crease of all of their tabs form an acute angle with the other of a portion of the longitudinal edge which is upstream, with respect to the flow of heating fluid, of the main body of its respective tab and a portion of the longitudinal edge which is downstream, with respect to the flow of heating fluid, of the main body of its respective tab; and

a plurality of webs, each web separating a tab from another tab adjacent the tab in a direction substantially perpendicular to the longitudinal axis of the tab, the crease of at least one tab being directly downstream, with respect to the flow of heating fluid, of the web between two other tabs which are adjacent and upstream, with respect to the flow of heating fluid, of the at least one tab;

wherein the number of tabs per unit length increases along the baffle plate in a downstream direction with respect to the flow of heating fluid.

* * * * *